

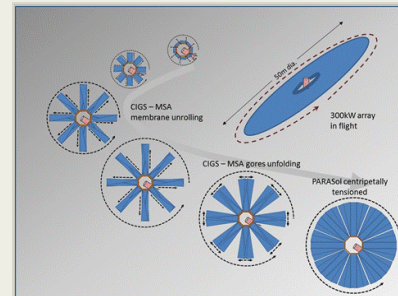
ParaSol - A Novel Deployable Approach for Very Large Ultra-lightweight Solar Arrays, Phase I

Completed Technology Project (2014 - 2014)



Project Introduction

High power solar arrays with capabilities of $>100\text{kW}$ are needed for projected NASA missions. Photovoltaic arrays using deployable membranes with thin cells have trended to higher efficiency cells to minimize deployed area and deployment structure mass and complexity, however, the cost of high efficiency cells make these arrays prohibitively expensive. Amorphous cells that are in production for terrestrial application have $\$/\text{Watt}$ cost less than 10% of space cells, at about the half the efficiency. This SBIR develops the Photovoltaic Assembly with Reconfigurable Array Structure - PARASol - a centripetal force deployment and tensioning approach that enables affordability of multi-100kW arrays with commercially available thin film CIGS cells, which can be adapted for space environment compatibility. PARASol implements CIGS cell modules using Vanguard's THINS solar cell encapsulation technology to achieve high mass and stowed volume metrics ($>500\text{W/kg}$, $>200\text{kW/m}^3$), and mount the CIGS-THINS modules onto a Membrane Solar Array (MSA) that can be rolled and folded into a compact envelope and deployed without cumbersome external deployment structure. In phase I we will develop the design and structural analysis of a 250kW PARASol MSA, selecting from flower-, umbrella-, or origami-like deployments, and evaluate figures of merit for the array when implemented with a combination of centripetal force and elastic or shape-memory integral ribs to deploy and tension the array. We will evaluate the alternative gore sizes and shapes to determine the maximum PV packing factor we can achieve. We will develop a plan for scaling up the technology and qualifying for space, addressing the key challenge of demonstrating and characterizing such a large array in ground-test with gravity off-loader. The Phase I completes with a subscale demonstration using a scalable version of the test fixture, leading to a plan forward towards flight experiment in Phase II.



ParaSol - A Novel Deployable Approach for Very Large Ultra-lightweight Solar Arrays Project Image

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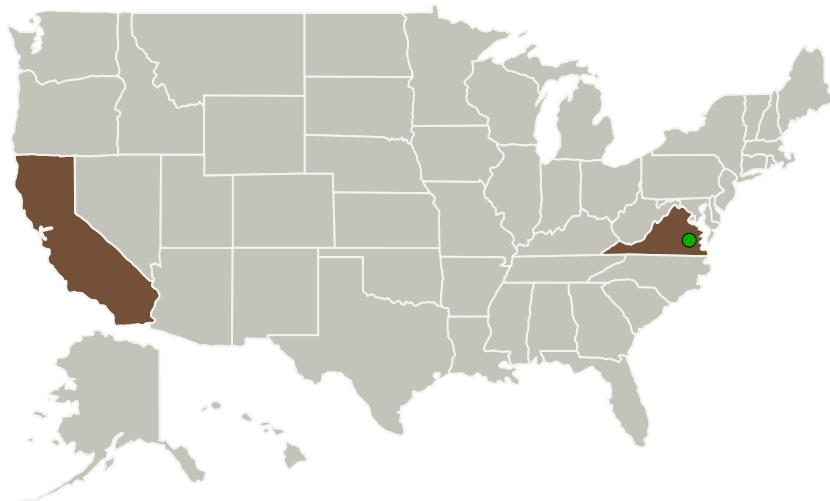
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Vanguard Space Technologies, Inc	Lead Organization	Industry	San Diego, California
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

California	Virginia
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Project Transitions

**June 2014:** Project Start**December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137660>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Vanguard Space Technologies, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

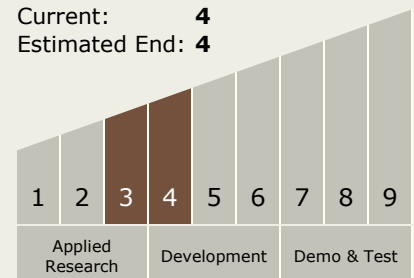
Program Manager:

Carlos Torrez

Principal Investigator:

Matthew Wrosch

Technology Maturity (TRL)

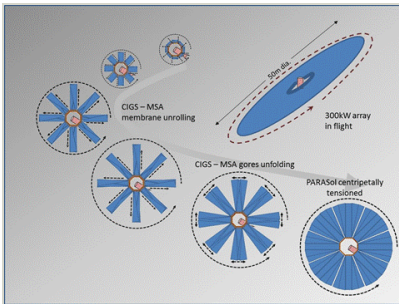
Start: **3**Current: **4**Estimated End: **4**

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Images



Project Image

ParaSol - A Novel Deployable Approach for Very Large Ultra-lightweight Solar Arrays Project Image

(<https://techport.nasa.gov/image/135979>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.2 Structures
 - └ TX12.2.1 Lightweight Concepts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System